

# McGill Daily

VOL. VI, NO. 57.

MONTREAL, WEDNESDAY, DECEMBER 6, 1916.

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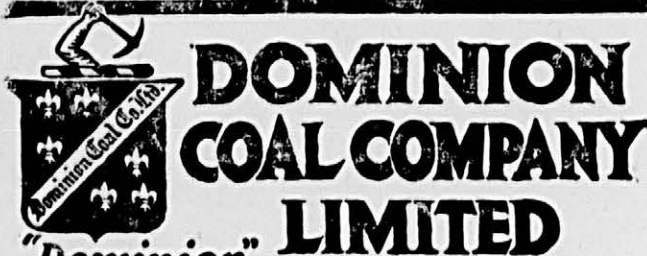
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## SAPPERS WORK RELATED BY A TRENCH PAPER

Interesting Account of the Start of a Night's Work in One Issue.

### WORK BEGINS AT DUSK.

Men Take Their Life in Their Hands Laughing and Joking.

The following is an extract from a newspaper called "The Western Scot," printed by a Harvard student about one mile behind the lines:

"Human life on almost any one of a number of war fronts is replete daily with sensations. Not a day or a night passes but someone experiences a thrill that is not common to peaceful days at home. And of all the thrills there is one that never fails of potency; it is that moment when one just throws a leg over the parapet to begin the night's job of sand bag filling and laying on the outside.

The sky is yet too bright, as the party winds in through the rear 'C' T. (as we veterans now dub communication trenches), and comes to a halt beyond the S line (which to the initiated conveys, of course, Support Line). It is the children's hour, twixt the dusk and the darkness, and the mixed party of Pioneers and sappers, as they lean up against damp sand bags, wish the night would hurry up and 'lower.' Behind them the sun, which looks impartially on wheat field and battle field, is setting in a great crown of crimson and gold. Against that sky everything that shows above the parapet stands out silhouetted as sharply as the shadow pictures our grandfathers loved to make in days gone by. Outside, who knows where hidden in shell-hole and stump, German snipers wait for a mark? The machine guns are only just beginning the night's work. Now and again, like a not too insistent landlord, they knock for their rent, and we hope receive but little. The day has been fair and the sun warm, and the evening wind drifts across the torn war-worn field, carrying the familiar odor of the trenches; an odor made up of the smell of damp earth, musty sand-bags, old graves and chloride of lime.

The light has faded noticeably and the engineer N. C. O. is bustling up and down locating shovels and empty sacks cached in many a dug-out and traverse. The working party has been told off, so many men to hold bags, so many with shovels to fill them, others to carry the filled sacks, still others to lay them in position on the parapet. 'You'll find good borrow pits close in to the line,' says the boss sapper, as he gives the party a final inspection. We'll wait about two courses all along this side to begin with.

Fritz has finished his frugal supper of sauer kraut and wein, apparently, and is devoting himself wholeheartedly to the opening strains of the evening hymn of hate. That he intends 'those Canadian pigs a good strafe to give' is perfectly patent. Machine guns are tuning up in a dozen places near at hand, the sharp crack of the sniper's bullet passing over the canyon of trench is regular and convincing, and at intervals there is the sizzling 'boom-whizzbang' of his field guns sweeping our lines.

The time has come to go over; no one is afraid; in a few minutes the whole party will be working away merrily; but there is just that moment to pass when one leaves the comparative security of the trench and projects one's devoted and tin sun-bonneted head into the turmoil of whistling lead.

Something moves along the opposite parapet, something that makes no sound as it noses from bag to bag. One of the party swings viciously with a shovel, and the monstrous thing disappears squealing. The man who struck curses, others laugh. The incident emphasizes the existent tension.

'All right, boys, come on.' The officer in charge swings himself up on the trench edge and throws a leg over the parapet. The men follow almost on top of him. The tension is broken. Someone slips, and a dozen giggles ripple along the line. A machine gun begins to sweep, and its leaded stream passes over one's head with a soft unbroken swish. Heads are ducked down on chests, and a muffled voice cheerfully derides the Hun's marksmanship. 'Frits, you square-headed, son of a sea-cook, what in blazes are you wasting ammunition like that for?'

'Steady!' a flare bursts like a white Dominion Day rocket. Every man holds rigid, and the glaring light bathes the group in radiance brighter than noon-day. Like a statuary study in old marble, every detail sharp and clear, some erect, some crouched, they stand gazing into the German line, a hundred yards away.

The flare dies suddenly, and welcome darkness blankets the party again. 'All jake boys!' A scurry of feet, a rattle of shovels, and the party is in the borrow pit and another night's work is begun.

### NEW BUILDINGS AT CINCINNATI UNIVERSITY.

Women and students of chemistry at the University of Cincinnati are extremely happy for the new woman's building and the new chemistry building, which are finished and ready for occupancy. Both are said to be the best equipped buildings of their kind in the middle west.

## WESTERN CLUB MEETING.

A meeting of the Western Club of McGill University will be held this evening at 7.30 in the Band Room, upstairs, in the Union.

For a number of years the Western Club was the most flourishing sectional club at McGill, but now its ranks are sadly depleted, owing to the relatively small number of Western men here now.

The causes responsible for this state of affairs are twofold in number—the splendid response which the men of the Western provinces have made to the call for recruits, and the opening last year of the University of B. C.

Nevertheless, there are at McGill this year many men eligible for membership in the club—men from either of the four western provinces: Manitoba, Saskatchewan, Alberta, or British Columbia; and an urgent appeal is made to all such students to turn out to-night to the meeting. The main business before the club will be the determining of its future policy, and so on the O shoulders of this meeting rests the destiny of one of McGill's most enterprising sectional clubs.

Turn out, all you Westerners, and don't let our club be one of ever-growing broken links in McGill's chain of student organizations.

The meeting will start promptly at 7.30, and the business will be run through as quickly as possible. Also "smokes" will be provided.

## THE FRENCH CLUB MEET THE SOCIÉTÉ

La Société Française Will Entertain the Cercle Français.

At 4.30 p.m. to-day, the members of the Société Française, as well as those of the Cercle Français, will have the splendid opportunity of hearing Mr. R. La Roque de Roquebrune deliver a lecture on the role that animals have played in literature. This is a very wide subject indeed, and one that concerns the literature of all times—from the earliest beginnings of civilization to our own time. No one who has read "The Bluebird," by M. Maeterlinck, or the "Call of the Wild," by the late Jack London, will fail to realize the importance of animals in literature.

However, it is not often that one hears a serious lecture on this subject—and that very rarely by a man like Mr. La Roque de Roquebrune, who has manifested great interest in nature in his collection of poems entitled "L'invitation à la Vie," and who, as lover of nature, must have made serious study of animals.

After the address, tea will be served. All the members of the above-mentioned societies are urged to be present at this meeting, and so to prove at least by their numbers their appreciation of the kindness of Mr. La Roque de Roquebrune in coming to deliver this address.

Remember the place—Common Room of R. V. C., and above all, don't forget the time—4.30 p.m.

### WHAT'S ON

#### TO-DAY.

1.45 p.m.—R. V. C. Basketball practice, M. A. A. A. gym.  
2.30 p.m.—Meeting of Y. W. C. A. at R. V. C. Common Room.  
4.30 p.m.—La Société Française meet Le Cercle Français at R. V. C.  
8.00 p.m.—Arts '20—'19 Smoker in Union.  
8.00 p.m.—Electric Club meeting.

#### COMING.

Dec. 7.—Conservatorium Orchestral Concert at R. V. C.  
Dec. 9.—Track Club Picture at 12.30 p.m.  
Dec. 11.—Students' Council Elections.  
Dec. 14.—Lecture at McGill Conservatorium.  
Dec. 15.—Union Informal Dance.  
Dec. 18.—McGill vs. Laval at Arena.

#### ELECTRIC CLUB MEETING.

At eight o'clock this evening, Mr. R. M. Wilson, chief electrical engineer of the Cedar Rapids Mfg. and Power Co., will speak before the members of the Electric Club. Mr. Wilson is a graduate of '99, and his lecture promises to be very interesting. Coming just before the proposed trip to Cedar Rapids, this address will be of peculiar interest to all those intending to take the trip, and a good turnout is expected. Mr. Wilson is the master of his subject, and nobody who hears him to-night will be disappointed.

Columbus people are benefiting by the equipment of the college of medicine at the University of Ohio at the rate of more than 500 a day, according to Dean McCampbell. This college has received an "A" rating from the American Medical Association. St. Francis Hospital, with 150 beds and capacity for 200; Protestant hospital, with 50 beds, and the Children's hospital, with 50 beds, brings the total of bed patients to 250, with out counting the free dispensary and ambulatory patients. These dispensaries are all operated by the college of medicine.

## MISS COLLIER ADDRESSES THE DELTA SIGMA

Talks About "Women in Shakespeare."

### CALLS PORTIA FIRST SUFFRAGETTE.

Shakespeare Was Influenced by His Wife, His Daughter, and Lady Mary Fitton.

A very delightful hour was spent by the Delta Sigma Society yesterday in listening to a short address given by Miss Constance Collier, (who is acting this week in the Princess Theatre), on "Women in Shakespeare."

Miss Collier began by giving a vivid picture of two of the poet's heroines, Lady Macbeth and Cleopatra.

"The case of the former," she said, "is that of an unimaginative woman married to an imaginative man. Lady Macbeth never understood her husband—her first speeches show no wickedness, only lack of understanding. Shakespeare gives Lady Macbeth a certain nobility in the banquet scene, where she sees all her hopes, everything that she has striven after for years, dashed to the ground. Surely there was something fine about Lady Macbeth."

Miss Collier then discoursed briefly on Cleopatra, Rosalind and Portia, "whom some people consider the first suffragette."

"Shakespeare had three inspirations, his wife, Anne Hathaway, who was older than he, and somewhat inclined to be a shrew. She was therefore the model for his Batherine, Beatrice, etc. Then, his daughter Judith gave him material for his sweeter type of women, for the child princess in Richard II 'plucking roses in the garden of the Mad King.'

"Thirdly, Lady Mary Fitton, the 'dark lady' of the sonnets, is presented to us in Viola, Imogen, and later Cleopatra.

There is a legend about this Lady Mary Fitton, that she was a girl at the Court of Queen Elizabeth, who used to speak kindly to the poet, an unusual thing for a girl of her high position to do. But Lady Mary was high-spirited, and often in trouble with the queen; she used often to go in disguise to the Globe Theatre, to enjoy the plays of this then humble actor, whom she used also to meet in the forest disguised as a page. It is said that she afterwards killed Shakespeare for some court gallant. But the poet immortalized her in his beautiful sonnets, as Dante did Beatrice."

Miss Collier dwelt at some length on Shakespeare as a philosopher, and then related some small incidents of her own life, of how she took the part of Peasblossom in "Midsummer Night's Dream," at the age of three, and of Puck, when eight years old.

Miss Collier concluded with a very interesting description of the festival held every year at Stratford-on-Avon, to celebrate Shakespeare's birthday, of the many people who came there to throw one bunch of flowers on the poet's grave. Everyone is allowed only the one bunch, for all must come as equals into the presence of Shakespeare.

The meeting closed with a speech of thanks given by Miss Cameron, on behalf of all students present.

## MANDOLIN CLUB HAD PHOTO TAKEN

Will Play at Meeting of Medical Society on Friday Night.

On Monday night, the Mandolin Club, attired in feathers and war-paint, held their regular practice and rehearsed the music which they intend to serve on Friday night before the members of the Medical Society. There is a treat in store for that learned body.

After practice they adjourned to Gordon's, where a highly artistic illuminant was waiting to throw its searching beams upon their classically chiselled countenances. The camera rose to its stupendous task and succeeded in withstanding two shocks before its owner concluded to grant it some respite. Orders for copies will be taken on Friday night at the Medical Society lecture.

Members are requested to meet on Friday evening at the New Medical Building at 8.30 sharp. Bring instruments and music.

## MED. FOOTBALL PHOTO.

The photo of the Champion O Medicine Football team for the 1918 Annual will be taken O at the Rice Studios on St. O Catherine St., on Friday, at O 5.15 p.m. The following men O are requested to turn out as O promptly as possible, and get O into the picture: Donnelly; O Deslauriers, Gilhooley, Touhey, O Fleck, Bushy, Fawcett, Taylor, O Hunter, McCulloch, Pitts, Pat- O terson, Parsons, Gibbs, Dowd, O MacDonald, Walters, Bulger, O Greenwood and Upham. O

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### PROF. HERDT'S ADDRESS TO THE ELECTRICAL CLUB.

(Continued from Page 4.)

The French Swedish Co., Societe Norwegienne de l'Azote, with headquarters in Paris, had sold out in 1910 to the Badische Anilin und Soda Fabrik Co. of Berlin. When I visited the plants in Norway in 1906, they were the property of the French Co., but even then the whole output of calcium nitrate was shipped in Norwegian bottoms to Hamburg. In 1907 the whole undertaking, patents and all, was turned over to the German company. Acting for some Canadian capitalists I endeavored to obtain patent rights for Canada of the Birkeland and Eyde Process. After lengthy negotiations, which up to 1910 appeared to be successful, I was advised, without much explanation, that the German company did not care to follow up the matter any further; the deeds of transfer had only to be signed at that time.

The thing that makes the process most interesting is its wonderful efficiency from the thermal and energy standpoint. There is actually used at Rjukanfos, Norway, 250,000 H.P., but there is actually utilized for the chemical operation 3,500 H.P. All the rest of the 250,000 H.P. is lost—the efficiency of the operation being 1.4 per cent. of the power used. The wonderful room for improvement is one of the most interesting and attractive researches to the electro-chemical engineer.

To those interested in the problem I would refer them to a paper by Summers entitled Atmospheric Nitrogen A.I.E.E., 1915. The theoretical limitation imposed by the laws of physical chemistry to such process involving chemical dynamics are set forth at length.

The most important factor upon which the cheapness of the process depends is cheap power, as it requires practically 3 C.E. H.P. per year at the electric plant per ton of nitrate. Cheap and large sources of power must be used to make the investment profitable.

Electrical energy in Norway is figured at \$7.00 per H.P. year, interest and depreciation included. If all the known water power in Norway were harnessed to develop electrical energy, and this energy used for the production of calcium nitrate, the production would not be one tenth of the world's consumption to-day.

Is the oxidation of nitrogen at the electrical discharge a purely thermal or an electrical effect, or again a mixture of both? This question is, I believe, not yet settled amongst scientists.

Summers states, p. 344, A molecule of nitrogen is composed of two or more atoms united together with a bond representing a large amount of energy. Nitrogen has an atomic weight of 14, and a molecule a weight of 28 indicating two.

It therefore seems certain that before the 25 years shall have elapsed since Sir Wm. Crookes made his memorable address, the Chili nitrate beds will have vastly curtailed their production—not from exhaustion—but from the inroads made by the onward advance of electro-chemical engineering.

The faculty of the University of Southern California has ruled that papers and examinations written with the new fangled simplified spelling will be perfectly acceptable.

Field hockey is a favorite sport among the women students of the University of Chicago. More than two hundred girls signed up in response to a recent call for candidates.

## CONCERT IN AID OF THE PRINCESS PATS

Miss Ellen Barron and Mr. Norman Nottley Will Appear on Programme of Women's Union Event.

With a view to providing field comforts for the men of the Princess Patricia's Canadian Light Infantry overseas, the McGill Women's Union will hold a concert at the Ritz Carlton Hotel on the evening of December 12, at which the soloists will include Miss Ellen Barron, one of the most brilliant graduates of the McGill Conservatorium of Music in pianoforte, and Mr. Norman Nottley, of the teaching staff of the Conservatorium. A feature of the concert will be the fact that returned members of the Princess Pats. will act as ushers.

Miss Barron, since leaving the Conservatorium, has studied under Joseffy and Hoffman, in New York City, and has offered her services to help the Princess Pats.

The patronesses will be Lady Meredith, Lady Roddick, Mesdames J. K. L. Ross, E. B. Greenfield, W. M. Birks, Howard Wilson and H. W. Ross.

**BRITAIN'S CADET TRAINING.** LONDON, England. The Lord Mayor of London lately held a conference at the Mansion House at which he outlined a scheme for the national organization of cadet training. He dwelt on the necessity for a representative body in close touch with naval, military and educational authorities. The conference passed a resolution approving the scheme, but urged that cadet training should be made compulsory throughout the country.

The Lord Mayor explained that the centre of the scheme was a council which would be in close touch on the naval side with the admiralty and naval cadet units, and on the military side with the Army Council, the Territorial Force associations, and the military or senior cadet units. To the council all questions affecting the cadet forces could be referred to be dealt with, or passed on to the Territorial associations. At the same time the Territorial Force associations would be in direct touch with cadet units in matters more essentially military. The Boys' and Church Lads' Brigades and other similar bodies should remain under their existing organizations, and be in touch with the council to such extent as they might find convenient.

With regard to the cadet himself, at the age of 9 he should become a junior scout. From the age of 11 to 15 he should be a full Baden-Powell scout, unless he joined the Boys' Brigade, Church Lads' Brigade or cadet organizations. At 14-15 on leaving school, he should have been so trained as to desire to become a senior cadet and remain under training until he attained military age and passed into the regular or territorial forces. The council would invite the formation of cadet committees in every county, and borough, and the appointment of a responsible officer to act as area staff officer, as in Australia. Such an organization as he had outlined would be ready at the end of the war, to be merged as a going concern in whatever system the Government might adopt for the reconstruction of the military forces of the Empire. It would do more; it

FRESHMAN-SOPHOMORE SMOKER.

The Arts-Sophomores are assured of having a good time this evening at the Union. The Freshmen are giving them a smoker, and have been working hard lately to give the Sophs. a treat.

Dean Moyses has been prevailed upon to be present, and to address the students. Mr. Philip Presner, who delighted his audience at the Arts Union, degrades smoker with his violin solos, has consented to play again this evening. Besides these, Mr. Suter will impersonate several of Dickens' characters, whilst the Strathcona Hall Orchestra will fill up the intervals with some of fine selections.

All the Freshmen are requested to be on hand to give the Sophs. an enjoyable evening, and it is up to the Sophs. to do justice to their efforts.

## MAJOR CORBET BACK IN COMMAND OF DEPOT

McGill Graduate Did Good Work in France With the Third Artillery Brigade.

Major G. G. Corbet, Med. '98, now officer in command of the Field Ambulance Depot at St. John, N.B., has a splendid record and experience as a campaigner. He has always been connected with some military organization, and was for some time medical officer for the 28th New Brunswick Dragoons. He later left that position and took a commission in the regiment. When war broke out he offered his services as a combatant along with the other members of the regiment, but as cavalrymen were not required, Major Corbet then offered his services to the Army Medical Corps, and was immediately accepted. He was then attached to the No. 1 General Hospital at Quebec, with Lieut.-Colonel Murray MacLaren, and which went overseas with the 10th Battalion on the Scandinavian. That awful winter of 1914-15 was put in on Salisbury Plain, and the No. 1 Hospital proved the saviour of the situation. There was a hospital at Bulford, another at Netheravon, and a third at Figheldene. Major Corbet went to France, and remained at Rouen for a time, but after the big battle of Ypres, when so many medical men were killed and wounded, he offered for service on the firing line, and was accepted, and was detailed as medical officer for the 3rd Artillery Brigade, which was made up of Toronto, Hamilton and St. Catharines men for the most part. He passed through some very heavy engagements with the 3rd Artillery Brigade, Festubert in May, Givenchy and LaBasse in June, and on September 20, when the British and French troops made their famous drive at Loos near Arras in an effort to recapture Lille, Major Corbet's brigade was the only Canadian force to be included in the big push. Speaking of the bombardment, he said that on September 25 it was estimated that one million shells were fired, and of the sixteen guns in his brigade they fired 4,400 shells that day. He was stationed near Ploegsteert for a while, and later at Lindenboek, near Kemel.

From thence he was transferred to No. 2 General Hospital for special duty, but shortly after the change injured his knee and himself became a patient. Later he was sent to Canada in charge of a party of invalided men, but returned again in April. On reaching England a second time he was detailed to act as registrar of the Canadian convalescent hospital at Bearwood, and some time later was recalled to Canada to take charge of the field ambulance depot here, which he now commands. Major Corbet therefore has a splendid war record, and it has been one of the big factors in the rapid recruiting of the field ambulance train. Mrs. Corbet was formerly a Miss Bird, of Montreal, and is a sister of Mrs. Duval, whose husband, Major J. L. Duval, Med. '98 died of wounds suffered in the fighting in the Ypres salient, and whose body was lost when the Hesperian was torpedoed.

Capt. J. A. McCarthy, who is adjutant of the field depot, is another well known McGill man, who has taken on the vestments of the king and proven an officer of splendid parts. He is a St. John boy, and graduated from McGill University in 1910, after studying at St. Joseph's College. Since that time he has been practising in St. John, and has made a specialty of X-ray work, which has won him not a little recognition in the medical field.

would provide a national manhood, disciplined and self-controlled, which, following the splendid example of the heroes of the war, would make the Empire not only sound to the core, but impregnable without and within.

Lord Chylesmore, in the course of discussion, maintained that cadet training should be in every case compulsory, but Sir Reginald Hennell considered that boys would come forward readily enough if the voluntary system were carried out in the proper manner. He advised the formation of committees which would have as their object the enlargement of all existing cadet corps, and the institution of new ones. Attention should be concentrated on the matter at once. If the best results had not been attained at the end of the war, however, the War Office should be approached with a compulsory scheme. Colonel Yate, M.P., also demanded a perfect system of compulsory physical education and physical training in the form of cadet corps, as part of the curriculum of all secondary schools. Captain Hoare urged that there was a danger, if compulsory training were adopted, that militarism might become too great a factor.

A proposal to form a National Association of Cadet Training and approving the scheme initiated by the Lord Mayor was moved, and seconded, but an amendment by Lord Chylesmore, that the movement should include the policy of compulsion, was subsequently carried.

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The length of the course is three years in three terms of 15 months each.

The total cost of the course, including board, uniform, instructional material, and all extras is about \$300.

The annual competitive examination for admission to the college, takes place in May of each year, at the headquarters of the several military districts.

For full particulars regarding this examination and for any other information, application should be made to the secretary of the Militia Council, Ottawa, Ont., or to the Commandant, Royal Military College, Kingston, Ont.

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## Prof. Herdt's Address to the Electrical Club.

(The following address was delivered by Prof. Herdt before the Electrical Club last Friday evening.—Ed. Note.)

Mr. President and Gentlemen,  
I am glad to meet you, the members of this Society, and to meet for the first time the Juniors amongst you. I have always felt a great interest in this Undergraduate Society, and I am particularly pleased to address you this evening at this, the first meeting of the Society in the year 1916.

My subject to-night is not one which will permit of great flights of eloquence. I did not select the subject; it was selected for me, first of all, I believe, by Mr. Burr, and subsequently by your President. I had no objection to it, however; the subject is interesting. It deals with the manufacture of a product which in the words of Sir William Crookes "will postpone the day of famine, the day of starvation, to so distant a period that we and our sons and grandsons may legitimately live without undue solicitude for the future." Let me explain:

In 1898, Sir William Crookes, in his Presidential address before the British Association for the Advancement of Science delivered at Bristol, alarmed at the rapid draining of the nitrate beds of South America, and well aware of the rapid impoverishment of the soil unless it is abundantly fertilized, voiced the following opinion, which sounded as a trumpet call over the whole world:

"By 1931, 231 million units will likely be added to the bread-eating population. Will the arable areas of the temperate zone now partially occupied grow the additional 330 million bushels of wheat required by a hungry world?"

He also added:—  
"Before we are in the grip of actual dearth will the client step in and postpone the day of famine to so distant a period that we and our sons and grandsons may legitimately live without undue solicitude for the future?"

"The fixation of Nitrogen is vital to the progress of civilized humanity. Other discoveries minister to an increased intellectual comfort, luxury or convenience; they serve to make life easier, to hasten the acquisition of wealth or to save time, health or worry; but the fixation of nitrogen unless we can class it among certainties to come, will mean the end of the great Caucasian race; it will be squeezed out of existence by races to whom wheat bread is not the staff of life."

These words were spoken in 1898 eighteen years ago. Sir Wm. Crookes was calling to the scientific world to avert starvation of the world through the laboratory. A few years after this trumpet call in 1906, a large factory was placed in operation in Norway, manufacturing an artificial product the equivalent of Chilean Saltpeter, or Nitrate of Soda, the best known of the imported fertilizers.

The industrial production of nitric acid and nitrates by utilizing electrical energy to cause the direct combination of atmospheric oxygen and nitrogen had been realized.

Nitrogen plays a great part in the vegetable kingdom. Plants must have nitrogen to live. It is a curious fact that only a few plants, such as clover, the immense resources of free nitrogen existing in the atmosphere. The great majority of plants and vegetables, wheat, oats, corn, etc., are obliged to obtain the azotized or nitrogenous compounds necessary to their life from the ground itself. The principal nitrogenized fertilizers are manure, dried blood, wool wastes, horn, leather, nitrate of soda, sulphate of ammonia, calcium cyanide and nitrate of lime. Of these the nitrate of soda, or Chile Saltpeter, found in its natural state in immense deposits situated in Chili, Peru and Bolivia, is the principal fertilizer. It is a nitrogen compound.

In 1913-14, just before the war, the exportation from Chili for 12 months amounted to over 3,000,000 tons. In 1830 the exports of Chilean nitrate were only 100 tons; in 1870 they had increased to 150,000 tons; in 1904 to 1½ million tons; ten years later to over 3 million tons.

Chili saltpeter was shipped from Chili to European countries before the war, mainly in English bottoms. It sold at a price of \$45.00 per ton f.o.b. Liverpool and gives an export tax of \$12.00 a ton to the Chilean Government, or between 35 and 40 million dollars revenue.

Years of exploration have shown that the Chilean deposits are the only natural deposits of nitrates in the world situated in accessible regions. It is also well recognized that these are not inexhaustible. Exact valuations are not possible, but experts declare that exhaustion such as is taking place will empty the Chilean mines by the year 1940 at the latest. Whatever it may be, as these natural deposits are of limited extent, and as climatic and geological conditions of the country are such that these deposits are no longer forming, it is

certain that their exhaustion will occur at some future date and that agriculture and industries depending on nitric acid for their manufacture, must look elsewhere for some similar product.

The nitrogenous compounds are used not only as fertilizers, but the compounds of nitrogen and oxygen are the nitric acid salts of commerce. The world's production of nitric acid is from 200,000 to 250,000 tons per year. 50 per cent. of all the Chili saltpeter exported is used in the manufacture of explosives, as all explosives have a nitrogen compound as the principal ingredient. The original black gunpowder uses Chili saltpeter, charcoal and sulphur. Smokeless powder utilizes Chili saltpeter that is nitric acid, in its composition. All the high explosives, cordite, lydit, mellonite, gunacotton, etc., require the inherent molecular energy of oxygen in their production.

The fixation of nitrogen is vital to the progress of civilized humanity; but above all, the fixation of nitrogen is vital to such countries as may be or are now shut off from the Chilean field. The recent realization of the industrial production of nitric acid and nitrates by utilizing electrical energy to cause the direct combination of atmospheric oxygen and nitrogen has enabled Germany and Austria to carry on this war whilst the soda nitrate fields were closed to them by Great Britain's command of the sea. We have here another instance of German preparedness, as I will show you presently.

The story of the fixation of atmospheric nitrogen can be summed up as follows:

The problem itself has been worked over for a century it being known nature fixed nitrogen of the atmosphere by means of electric discharges and Cavendish in 1781 had shown that a small amount of nitrogen was converted into nitric acid in the combustion of hydrogen with oxygen to form water. Fixation processes experimented upon in the last twenty years are to be counted by the hundreds. The majority of these are still experimental. Of the various processes which have reached the state of commercial application, there are four distinct lines of development.

(1) The production of nitric acid directly from the atmosphere by means of the electric arc. In this process the nitrogen of the atmosphere is directly combined with its accompanying oxygen without utilizing any other chemical substances, the product consisting essentially of a powerful acid furnace through which air is forced, causing at this high temperature the nitrogen to combine with the oxygen forming nitric oxide, NO.

(2) Fixing nitrogen by means of an electric furnace where the energy of chemical combination is utilized, causing the nitrogen to combine with some substance with which there is a pronounced energy of chemical combination. These processes include furnaces utilizing calcium carbide with which nitrogen readily combines to form calcium cyanide CaCN<sub>2</sub>, and various processes for making combinations of nitrogen and a basic or alkaline earth metal such as calcium nitride CaN<sub>2</sub> or magnesium nitride, Mg<sub>3</sub>N<sub>2</sub>, or Aluminum Nitride AlN. The chemical action usually forming a nitride or carbo-nitride.

(3) Processes for producing ammonia, NH<sub>3</sub>, directly from nitrogen and hydrogen. These include the efforts to force the various forms of electric discharge by which the nitrogen molecule may be decomposed, and in the presence of hydrogen form ammonia.

(4) Producing a high temperature by means of the explosion or combination of gases directly combining the nitrogen and oxygen to form nitric oxide, NO. The NO formed is recovered and converted into nitric acid HNO<sub>3</sub>.

The processes to which I shall confine my remarks are those enumerated (1), namely, the process of nitric acid, nitrates or nitrides directly from the atmosphere by the oxidation of nitrogen or the fixation of nitrogen by means of electric arcs.

The production of nitric acid from air by electricity is based on the effect of the electric spark or arc on air. When an electric arc is discharged through air the air immediately surrounding it undergoes a change, the oxygen and nitrogen of the air unite to form NO and NO<sub>2</sub>. The oxide of the nitrogen thus formed can be turned into nitric acid; and nitrates follow from a natural order of things, so to speak. At the beginning of this twentieth century, a whole series of experiments were made to lay out conditions for the attainment of an advantageous output of nitric acid for a given amount of electrical energy expended. These attempts were not very encouraging, and the commercial solution of the nitrogen problem seemed very far off.

Amongst such experiments can be cited Gaye in Switzerland, Bradley and Lovejoy in the United States, Kowalski and Mosicki in Freiburg. The fundamental idea running all through their experiments is the necessity of obtaining electric arcs of the greatest possible length and the smallest possible section in order that the greatest volume of air might be brought into contact with the surface of the arc. This meant high voltages and multiplicity of arcs.

Bradley and Lovejoy, in their installation of Niagara used electric furnaces, where the arcs were struck between movable contacts, and they obtained a countless number of small arcs, as much as 400,000 per minute in a furnace of a few kilowatts. The apparatus was complicated, and costly as well as subjected to very rapid deterioration. A large amount of power was required to rotate large iron cylinders forming the furnaces, and the yield was so small that the cost of production on a large scale was greater than the corresponding price for sodium nitrate.

Birkeland and Eyde, in Norway, in 1903, had observed that the electric discharges of a moderately high voltage alternating current is spread out in the form of a circular sheet when subjected to a magnetic field, and that in passing air through that luminous sheet the oxidation of nitrogen was greatly accelerated. They saw the possibility of using lower

voltages, greater units and less costly apparatus, and therefore of obtaining much cheaper cost of manufacture.

The Birkeland and Eyde furnace Fig. 1, has been extensively used. Its most distinctive features are the use of electro-magnets, which distort the arc tube copper electrodes placed flame extending radially outward from the electrodes. The air enters the furnace and is distributed to the arc through holes in the firebrick lining of the furnace. The products are withdrawn from the periphery of the furnace.

Fig. 2 shows this disc flame as it was photographed. The electrodes are tube copper electrodes placed equatorially between the poles of the powerful electromagnets. The electrodes are water cooled and are placed about ½ in. apart. The working potential between electrodes is 5,000 volts at 50 cycles. When the flame is burning it emits a loud noise due to the interruption of the arcs. From oscillographic test it has been observed that a series of rapidly expanding arcs are formed in the flame at each reversal of the current, and that several hundred arcs per second are formed, although the alternating current employed has 50 periods per second. As the arcs travel radially outward the contact of the ionized air stream with the incoming air disrupts the nitrogen molecule and causes the formation of NO and the gaseous products travel rapidly to the periphery of the furnace, where they are withdrawn at an average temperature of about 1,250 degrees cent. The concentration is from 1 to 1.5 per cent. of NO.

There were at the time of my visit to this plant at Notodden, Norway, 32 electric furnaces of 1,000 E.H.P. each installed in this one room. The more recent furnaces of Birkeland and Eyde are of 3,000 K.W. capacity each, and give concentrations of two per cent. NO, and a yield of 580 to 600 kilograms of nitric acid per K.W. per year.

To provide the energy for this plant a large hydro-electric plant has been built at Svaegpos by this company. Four wheels working under a head of 120 feet are directly coupled to 4 electric generators of 10,000 K.W. each, giving a total of 42,000 K.W. Energy is transmitted to Notodden a distance of 4 miles at 5,000 volts, through 3 heavy transmission lines, of two circuits each.

The air or gas that comes from the electric furnaces at a temperature of from 1,000 to 1,200 deg. cent. are passed through steam boilers to cool them. The steam thus raised is employed in the further manufacture of the ultimate product, calcium nitrate. The temperature of the gases is thus brought down to about 200 deg., but they are further cooled to about 50 deg. in a cooling apparatus. The gases then enter into absorption towers, where the gas is converted into nitric acid. The absorption system consists of huge stone towers 63 feet high by 35 feet in diameter, over which water and the nitric acid formed are made to trickle. Acid is concentrated up to 50 per cent., at which density it is pumped to open granite tanks, where it is temporarily stored. The acid is then carried to a series of neutralization tanks, where it is converted into a neutral solution of neutral calcium nitrate. This neutral lye is carried further into vaporization chambers of iron, where it is vaporized to a boiling point answering to a concentration of from 75 to 80 per cent. of calcium nitrate containing about 13.5 per cent. of nitrogen. This substance is then run into drums, where it congeals, and in that form appears on the market.

Nitric acid of commerce is manufactured from soda nitrate by treatment with sulphuric acid, about 72 per cent. of the sodium nitrate being nitric acid.

The Norwegian Nitrogen Company and its subsidiary companies, have undertaken solely for the needs of their industry the construction of a number of hydro-electric plants, the total capacity of which will reach the figure of 540,000 H.P. Four plants of 180,000 H.P. were in operation in 1914. 720,000 H.P. will produce 250,000 tons of nitrate a year. In 191 German imported 725,000 tons of nitrate of soda niter, whilst England imported 135,000 tons only. When it is remembered that the Chilean saltpeter is the base of the manufacture of powder and explosives, these figures tell a tale.

The Norwegian plants were built in 1904 to 1907, with French money. At Notodden and Rjukanfos, in a valley that ten years ago contained five houses, there was in 1910 a town of 10,000 inhabitants, with a power plant of 250,000 H.P. shipping the nitrate of lime to Hamburg, Germany.

(Continued on Page 3.)

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At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

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The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of \$10.00 on issue. It is valid for one year, and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days' labor on each forty acres.

### MINING CONCESSION.

Notwithstanding the above, a mining concession may be acquired at any time at the rate of \$5.00 an acre for SUPERIOR METALS, and \$3.00 an acre for INFERIOR MINERALS.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

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